THE ROLE OF LEADERSHIP IN CURRICULUM TRANSFORMATION: IMPLICATIONS FOR SCIENCE, TECHNOLOGY, ENGINEERING, ARTS AND MATHEMATICS IN HIGHER EDUCATION

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Abstract

Leaders in Higher Educational Institutions (HEIs) worldwide are confronting multifaceted challenges. The aim of the research was to explore the role of leadership in curriculum transformation, and the implications of this for Science, Technology, Engineering, Arts and Mathematics (STEAM) in Higher Education (HE). An inductive, interpretivist research adopting a qualitative approach was employed. Thirty participants were purposively selected to participate in a hybrid workshop. Nineteen participants were engaged in Science, Technology, Engineering, and Mathematics (STEM) and eleven in Management. Data was generated from participants' responses relating to leadership problems experienced in effecting curriculum transformation, and how leadership impedes and enables transformation. Findings revealed that communication, bureaucracy, and resistance to change are critical for leaders in effecting curriculum transformation and the introduction of STEAM. Leadership in HEIs can enable transformation by providing support, direction, motivation, funding, and engaging with staff. Effective leadership in STEAM education plays a pivotal role in curriculum transformation and guiding academics and students towards an integrated and holistic approach to science education. Since leadership in STEAM education is essential for fostering innovation and creativity in HEIs, their provision of support, direction, motivation, funding, and engagement with staff, is critical.

Keywords: *curriculum transformation, higher education, higher educational institutions, leadership in STEAM, STEAM*

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Introduction

Globally, Higher Educational Institutions (HEIs) are operating in a volatile, uncertain, complex, and ambiguous (VUCA) environment (Bennett & Lemoine, 2014) where they are confronted by a variety of challenges (James et al., 2025; Gerwel Proches et al., 2025). The challenges include the need for relevance and adaptability, globalization, technological integration, financial constraints, and evolving expectations from staff and students (Lemoine et al., 2017; Waller et al., 2019). The COVID-19 pandemic accelerated the need for HEIs to restructure, particularly in terms of curriculum design and development (Berthoud et al., 2021; Waldeck et al., 2024).

The study is part of the DECART project (Designing Higher Education Curricula for Agility, Resilience, and Transformation). The DECART project involves six HEI partners from France, Germany, Lithuania, Iceland, Indonesia, and South Africa. There are three work packages in the project, focusing on curriculum design, resilience, and transformation.

Research Problem

Science, Technology, Engineering, Arts, and Mathematics (STEAM) education has emerged as a pivotal approach for future-ready learning. While both Science, Technology, Engineering, and Mathematics (STEM) and STEAM emphasize scientific concepts through inquiry and problem-based learning, STEAM uniquely incorporates the arts, fostering creativity alongside technical proficiency (Carter et al., 2021). This integration should encourage risk-taking, collaborative and experiential learning, and perseverance in problem-solving, aiming to cultivate future leaders, innovators, scientists, engineers, educators, entrepreneurs, and lifelong learners.

The inclusion of the arts in STEAM is designed to enhance creativity (Razi & Zhou, 2022) – a skill identified by the World Economic Forum as one of the top three skills required for the future workforce (World Economic Forum, 2016). As people navigate the Fourth Industrial Revolution (4IR), characterized by breakthroughs in artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3D printing, and biotechnology, the demand for a workforce that is not only technically adept but also creative and innovative has become paramount (Penprase, 2018). Developing such a skill set necessitates curricular reforms and the provision of diverse programs and projects that offer teachers and learners opportunities to engage with various approaches and strategies, thereby fostering the competencies essential for success in this rapidly evolving landscape (Schwab, 2024). It is argued that "Substantial changes to the science and technology curriculum will be required to allow for students to develop capacity in the rapidly emerging areas of genomics, data science, AI, robotics and nanomaterials" (Penprase, 2018, p. 217).

STEAM with A for arts has been conceived as an alternative to STEM pedagogy helps students develop a well-rounded skill set and to promote creativity. Creativity, an important skill, is placed "third out of 10 skills needed for the future of work" (World Economic Forum, 2016, p. 21). Creativity is one of the most important job skills that companies are currently looking for and what is needed to succeed in the 4IR (Penprase, 2018; Shatunova et al., 2019). The 4IR is the technology breakthroughs in fields such as

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artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3-D printing, biotechnology, etc. (Penprase, 2018). Therefore, the workforce that is required needs to have new ways of thinking, be digitally competent, creative, understand technical topics, and also apply creativity in innovative ways to reshape our future (Shatunova et al., 2019). The development of this skill is possible with changes in the schooling curriculum and opportunities for teachers and learners through various programmes, projects, etc., using a variety of approaches and strategies (Penprase, 2018).

Research Focus

Despite global initiatives to advance STEM education, numerous scholars contend that achieving this objective remains challenging (da Costa, 2019; Osborne & Dillon, 2008). This difficulty may stem from teachers' need for a solid content knowledge base in the subjects they aim to integrate (English, 2017; Kim & Bolger, 2016). Therefore, it is essential to offer teachers professional development programs (PDPs) that equip them with the necessary knowledge and skills to meet these goals. Developing effective PDPs involves creating collaborative workshops where teachers can practice the methods they are expected to implement in the classroom (Afonso et al., 2005). To promote an integrative STEM teaching and learning approach, it is crucial to provide teachers with opportunities to deepen their understanding of mathematics and science content (Ríordáin et al., 2016). These authors also emphasize that school-level support is vital for the successful adoption of integrative methods. Ultimately, PDPs are effective only when teachers acquire the skills to apply their learning in classroom settings (Buczynski & Hansen, 2010).

McCauley and Fick-Cooper (2024, p. 2) have defined "leadership as a social process that enables individuals to work together to achieve results that they could never achieve working alone". Drath et al. (2008) have argued that there are two types of leadership ontology – the tripod and DAC (Direction, Alignment, and Commitment) – which may guide a researcher. First, the tripod ontology of leadership entails leaders, followers, and common goals. Drath et al. (2008, p. 635) have argued that the tripod "is an expression of commitment to the entities (leaders, followers, common goals) that are essential and indispensable to leadership and about which any theory of leadership must therefore speak". The tripod is explicit that it is erroneous to define leadership without focusing on the interactions between the leader, follower, and common goal with full recognition that leadership is about what people do together, rather than what a leader does or the capabilities he or she has. However, the criticism of understanding leadership as a tripod is that it emphasises the dyadic and hierarchical influence of a leader on followers, but is silent on the lateral influence of peers and external stakeholders (Drath et al., 2008).

Second, the DAC ontology of leadership is distinctive because it acknowledges the need for a clear shared direction, alignment, and commitment whether in a group, department, or organisation to achieve the common goal (Drath et al., 2008). The direction as a leadership outcome is characterised by widespread agreement on vision, mission, objective, and what the leader and followers are trying to accomplish together. One of the key functions of leadership is to communicate the vision and clear direction to followers (McCauley & Fick-Cooper, 2024). For example, transformational leaders

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champion the integration of innovative teaching methods and advanced technologies, such as artificial intelligence, virtual reality, and data analytics, to enhance learning experiences.

The other leadership outcome is alignment – which refers to the effective organisation and coordination of knowledge and work in a collective in service of their shared direction. To achieve results, aligning diverse individuals and groups to work together towards shared goals and objectives is a key function of leadership. Effective alignment requires that everyone knows what they are doing and why, what is happening in other parts of the organisation, and how their work connects with others (McCauley & Fick-Cooper, 2024). Building and developing others is another key function of leadership in pursuit of short and long term objectives. Modeling the way is a key function of leadership, especially in that it provides signals to what is expected and appropriate (or not) in the collective.

Lastly, commitment as a leadership outcome underscores the willingness of members of a collective (team, taskforce, department, entire organisation) to subsume their own interests and to prioritise the collective interest (Drath et al., 2008). Leadership has the function of engaging the human element of the organisation, not only to achieve goals and objectives but also to build and develop individual and the organisation`s future capacities. DAC as a way of understanding leadership moves beyond the idea of dyadic influence between leaders, followers, and shared goals, as it states that leadership happens when there is multiple social influence and groups of people are producing direction, alignment, and commitment (McCauley & Fick-Cooper, 2024). Given the Tripod and DAC ontologies of leadership, Covey (2021) has summarised that the four essential roles of leadership are creating a shared vision and strategy and communicating it powerfully so that others join on the journey; inspiring trust to build teams which achieve results, developing the potential in others and the organisation to improve performance; and translating strategy into actions and results with and through others in an aligned organisational environment which focuses on what is most important and makes it easier to get work done (Covey, 2021).

It is prudent that research on leadership and curriculum transformation not only focus on the dyadic social influence and interactions of the leader, follower, and pursuit of common goals. In pursuit of the common goal of curriculum transformation within STEAM education in HEIs, it is essential that scholars seek to understand the roles and functions of leadership, and how leaders and various stakeholders agree on the collective`s shared direction, align for effective coordination of work in service of the shared direction and ensure strong commitment of various stakeholders to prioritize the success of the collective.

The DECART project is about STEM and Management. But, for the purposes of this paper, the focus is on STEAM, as this is the progressive development from STEM, which includes the Arts. Many studies on STEAM have employed quantitative methods (Neldarisasmita et al., 2025), and a qualitative method is employed here. A gap is present in the literature on effective leadership models that can support STEAM education (Zarei et al., 2024). This study offers pertinent aspects to be considered in leadership in the context of STEAM. Furthermore, leadership in STEAM during the VUCA contexts is considered.

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Research Aim

The aim of the study was to explore the role of leadership in curriculum transformation and thereby derive implications for STEAM in HE.

Research Methodology

General Background

This exploratory, qualitative study used an interpretivist paradigm, given that it was considered suitable to gather multiple and subjective views of participants (Cohen et al., 2018) on the role of leadership in curriculum transformation, in STEM education. The workshop was held in hybrid mode and lasted two hours.

Sample

Census sampling was used to get thirty academics working in the field of STEM and Management with expressed interest in curriculum transformation in HE. The academics were between the ages of 35-60 years. Fourteen were male and sixteen females. Two French, two Lithuanian, four Indonesian, one Icelandic, one German, two Zimbabwean, two Latvian, and 16 South Africans participated in the study. Nineteen academics in this study were engaged in STEM (Engineering, Physics and Chemistry, Mathematics, Computer Science, Life Sciences) and 11 in Management (Business Studies, Economics). Of these participants, 14 in total were members of the DECART project.

Instrument and Procedures

The participants were invited to participate in a workshop exploring the role of leadership in curriculum transformation. A set of three reflective questions was prepared using Mentimeter. Mentimeter is an interactive, real-time polling digital tool, which provides participants with an opportunity to share their views (up to three responses can be added per participant), and also their responses can be collectively shown and observed. The three reflective questions were: *1. What leadership problems are experienced in effecting curriculum transformation, 2. How does leadership impede transformation, and 3. How does leadership enable transformation?* The participants' responses were captured using Mentimeter. The workshop and the tools employed, are aligned with the interpretive paradigm, which seeks multiple perspectives. Ethical clearance was obtained from the University of KwaZulu-Natal to conduct the study.

Some participants joined the workshop via Zoom, and others were in person. Participants worked in groups; three groups in person, and one online group. Groups were formed by allocating a number (1, 2, or 3) to each participant in the physical room. Participants engaged in discussions on their responses to the three questions presented to them.

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Data Analysis

The workshop was recorded, onsite and online, and transcriptions obtained. Data were analysed using thematic analysis. This involved breaking down transcribed data into labels, which were subsequently compared to each other to get patterns. The identified patterns reveal similar themes relevant to this study.

Research Results

First, the results reflect the responses to the three questions as observed on the different Mentimeter screens, and then the themes. Figures 1, 2, and 3 provide the responses to the Mentimeter.

Responses to the three questions as shown on the three Mentimeter screens.

Figure 1

Leadership Problems Experienced in Effecting Curriculum Transformation

Participants highlighted that the main leadership problems that were experienced in effecting curriculum transformation, as per Figure 1, were communication and bureaucracy. Other responses included change management, resistance to change, inflexible system, policy constraining, insufficient funding, lack of skills, lack of interest, no motivation, and divergent points of view.

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Figure 2
Leadership Factors Impeding Curriculum Transformation

As per Figure 2, participants mentioned resistance to change as a key way in which leadership impedes curriculum transformation. Other responses include being closed to alternatives, top down decision-making, slow decision-making, slow feedback, control, bureaucracy, restriction, rigidity, detachment, resource constraints, lack of vision, stubbornness, political barriers, and lack of EQ (Emotional Quotient / Emotional Intelligence).

Figure 3
Leadership Factors Enabling Curriculum Transformation

Enablers, as highlighted in Figure 3, include engagement, funding, support, providing direction, having a clear vision and strategy, motivating stakeholders, and having resources. Other responses include being helpful, encouraging, forward-thinking, professionally developed, and providing academic support.

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Themes

Complexities of Curriculum Transformation

The results revealed that curriculum transformation is a complex process impacted by bureaucratic inefficiencies, slow decision making, leadership styles, resource constraints, multi-level systemic factors, and political contexts. Participants noted how critical agile decision-making, visionary leadership, and a strategic approach that balances internal and external demands is to ensure curriculum transformation.

"... the problem we identified firstly is lack of communication. So, communication inhibits curriculum development."

Participants identified several factors that contribute to slow decision-making, including a lack of deadlines, insufficient discussion, and the tendency to "put on the back burner" important issues. The lack of "feedback on an idea and a creative aspect" further impedes the process of change. The need for "training in project management" was suggested as a potential solution to improve decision-making efficiency.

The findings revealed that bureaucratic centralized control limits diverse perspectives and stifles innovation. When a small group holds exclusive power, it creates an environment where alternative ideas are suppressed, and change is perceived as a threat to their authority. This limited input creates an environment where those outside of the small group feel that their voices are not heard. The data revealed a consistent theme: bureaucracy, characterized by centralized control and limited collaboration, fosters resistance to change by creating a disconnect between policy and practice.

"And so policies and procedures are made, but not in the understanding of what is actually happening on the ground level."

Centralized decision-making, bureaucratic hurdles, and slow feedback loops further exacerbate the resistance, making it difficult to implement necessary reforms. Political barriers and detachment from on-the-ground realities also hinder transformation efforts, emphasizing the need for adaptive leadership and proactive engagement with stakeholders.

When staff and faculty are excluded from decision-making, they feel disengaged and uninvested in the outcomes. This lack of buy-in creates a natural resistance to change, as individuals are less likely to support initiatives they had no part in shaping. It also can create a knowledge deficit, where the small group making the decisions do not have all of the needed information.

Creating Conducive Systems

The results shed light on how structural and systemic issues within HEIs also play a pivotal role in shaping the trajectory of curriculum transformation. Participants emphasized the importance of aligning organizational structures, systems, and procedures with the goals of change. This highlights the necessity of creating a supportive organizational framework that facilitates rather than obstructs change.

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"So, to implement something, there's a need to look at the structure, the organizational structure, the hierarchy, the arrangement of different elements. Because change may become difficult because probably there's no structure appropriate for that. And then you have to look at the systems, the processes, and the procedures of how work is going to be done, you know, and how decisions are going to be made."

A recurring theme is the need to shift from traditional power dynamics in education. The critique of "top-down" approaches to curriculum development and the call for "joint engagement" reflect a desire to democratize the educational process. The recognition that "we as academics are not the ones to be disseminating knowledge from a power perspective as knowers" underscores the need to embrace a more collaborative and student-centered approach to teaching and learning. The acknowledgment that "you are silenced" within institutions highlights the power imbalances that can hinder open dialogue and critical reflection. The call for educators to "share honestly" and "courageously" reflects a desire to create a more equitable and inclusive educational environment.

Resistance to Change

It was highlighted that a critical inhibitor of curriculum transformation is resistance to change, particularly among faculty members. The discussion identifies that resistance may stem from various stakeholders, including lecturers, students, and industry partners. Factors contributing to this resistance include traditional mindsets, lack of motivation, and fear of disrupting established curricula. It was argued that there is a need for strategic leadership that motivates stakeholders and fosters a culture of adaptability. Overcoming this challenge is important for ensuring that academic programmes remain relevant to evolving industry and societal needs. This theme underscores the importance of thoughtful and strategic change management.

"This is the essence of resistance to change. The people don't want to change. And if they don't want to change, they're going to forget about it. They're going to have a lack of a deadline. There's going to be a delay in taking action. So, the first question you have to really look at is How do we overcome resistance to change?"

"Resistance to change is something, but too many changes are another point. I think each time a leader comes in, he wants to change. And so, what's the purpose of changing for changing? Sometimes there is no purpose, real purpose."

Political barriers, detachment of leadership, and hierarchical decision-making structures further complicate the process. Attitudes toward change play a crucial role in determining the success of curriculum reforms. Some faculty members view change as unnecessary or disruptive, particularly when changes are frequent and lack clear objectives. The discussion raises concerns about the phenomenon of "change for the sake of change," where successive leadership transitions introduce new reforms without proper evaluation of previous initiatives.

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Leadership plays a pivotal role in navigating resistance to change. Ineffective leadership, lack of clear vision, and poor communication contribute to faculty and student resistance. Furthermore, escalating decisions to higher administrative levels or broadening the scope of ideas or implementation space can inadvertently suppress innovative ideas. Effective leadership requires balancing strategic oversight with grassroots involvement. Leaders must actively engage faculty and students in decision-making, fostering a sense of ownership over the change process.

The study findings also highlighted a perceived disconnect between curriculum content and real-world applications. Resistance arises when curriculum changes do not align with industry needs or fail to consider student perspectives. The discussion suggests that elitism in academia, coupled with rigid disciplinary boundaries, limits the practical relevance of curricula. Engaging students, industry professionals, and community stakeholders in curriculum development can enhance relevance and reduce resistance.

The long-term nature of change was also raised as a concern. Resistance to change is not a short-term issue but an ongoing challenge in academic institutions. The discussion underscores that even after several years, HEIs may struggle to implement meaningful change. This highlights the need for adaptability, long-term commitment, sustained dialogue, and iterative approaches to reform.

"And the other big thing is, don't expect that this thing will work in one year, two years, five years, even 10 years down the line. We'll be sitting here, and we'll be having the same conversations that we would have moved just an inch. So, we're always fighting against this wave."

Leadership and Organisational Culture

Participants highlighted the "big, big elephant in the room," which referred to leadership and management styles. Mention was made of slow decision-making, which suggests a need for more decisive and proactive leadership. The call for quick decision-making reflects a desire for greater agility and responsiveness in the curriculum transformation process. Participant responses indicate that the effectiveness of curriculum transformation is closely tied to leadership styles and management systems.

"So, when making change, you need to look at the structure, you need to look at the system. There was talk of style of, you know, leadership and style of management, which is within the organization, you know, trying to run away from making decisions or leadership style that is quick in making decisions, so on and so forth. That is also important."

"And I've learned over the years, if somebody says, oh, that's a brilliant idea. Let's not only do that in our faculty, let's get all the faculties on board. That is the quickest way to shoot something down. So, it already helps you if you have that awareness that these elegant tricks of escalating it up in the university will actually crush the whole idea."

The results reveal that it is critical to move beyond traditional, static curricular frameworks to embrace more dynamic and inclusive approaches. Leadership plays an important role in curriculum transformation by fostering collaboration among all relevant parties–faculty, students, community members, and industry experts. A top-

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down approach often results in disengagement, whereas participative leadership creates an environment where knowledge is co-created rather than imposed. Encouraging discussions and negotiations with all stakeholders ensures that the curriculum reflects diverse perspectives and remains relevant to real-world needs.

Collaborative and Participatory Leadership

Participants highlighted the importance of collaboration in leadership. Responses indicate that leadership is not about imposing decisions but rather about actively listening, engaging with stakeholders, and fostering teamwork. Effective leaders in curriculum transformation must facilitate dialogue between faculty, students, administrators, and external partners to ensure that reforms are well-received. Participants noted that clear communication of goals, strategies, and expectations is essential for successful transformation. Without clarity and stakeholder engagement, even the most well-intended reforms may fail due to misalignment or lack of support. This theme aligns with participatory leadership, where decisions are made through inclusive discussions rather than being dictated by a single authority. Such an approach encourages ownership, accountability, and greater buy-in from all parties involved.

"... good group management, good leader who will hear every member of the group. Also, clear communication on the goals."

"So, a leader has to set a very good relationship, collaboration with all stakeholders, and also the ethics has to be there."

Strategy

Strategic deficiencies emerged as a significant impediment. Participants identified strategy itself as a problematic element, encompassing planning, goal achievement, and competitive advantage. The lack of a clear, well-communicated strategy, coupled with inadequate evaluation and monitoring, contributes to the challenges of curriculum transformation. The importance of data-driven decisions and continuous support was also raised, showing that a lack of strategic oversight hampers progress.

Strategic Leadership

Participants indicated that a strong vision is critical, which appears to be the backbone of transformational leadership. Leaders in education must not only articulate a clear vision for curriculum transformation but also ensure that this vision is supported by well-defined strategies, policies, and resource allocation. It was observed that key elements of strategic leadership, which include mission and vision clarity, resource management, policy development, motivation, and inspiration, are relevant in the discussion around curriculum transformation. Mission and vision clarity proposes that leaders must ensure that all stakeholders understand the direction of transformation. Resource management implies, financial, human, and infrastructural resources must be aligned to support the change. Concerning policy development, leaders must work within accreditation standards and educational policies to implement reforms effectively.

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Finally, motivation and inspiration imply that leadership is not just about administration; it involves inspiring and motivating teams to embrace change and innovation. Without a strong vision and strategic planning, curriculum transformation efforts may lack direction, leading to fragmented and unsustainable changes.

"Leadership components as a vision, vision and mission strategy communication, then also resources that include financial resources… and maybe also infrastructure resources."

"They need certain skills, right, to be a visionary and to be able to set policy. And also, a leader has to have the ability to deal with the accreditation standard. And also, a leader has to have a motivation skill, has to be a motivator."

Inclusive, Inspirational, and Ethical Leadership

The results revealed that leaders must be inspirational and passionate, open-minded and inclusive, and accountable and transparent. Inspirational and passionate implies that leaders should not only manage change but also inspire confidence, trust, and motivation among faculty and students. Open-minded and inclusive implies inclusive leadership fosters diverse perspectives, equity, and broad participation in decision-making. Accountable and transparent leadership places the emphasis on monitoring and evaluation, indicating that curriculum transformation must be continuously assessed to ensure alignment with shared values and institutional goals. Networking and relationship-building also play a role in ensuring that transformation is not an isolated process but one that integrates diverse voices and perspectives. Ethical leadership ensures that curriculum changes address broader social and cultural dynamics, preventing exclusionary practices.

"And so, and hence the interpersonal skills that a leader has to have are inspirational to inspire all the stakeholders to follow the vision. And also, emotional skills as a leader has to have it, and also the passion and open-mindedness. And for the inclusivity, I think that we think that networking is very important."

Resilience in Leadership

The study findings indicated that resilience is a critical leadership trait in navigating curriculum transformation. The ability to adapt to change, manage uncertainties, and maintain persistence in the face of resistance is fundamental to successful leadership. The results emphasise that curriculum transformation is a continuous and often challenging process, requiring leaders to endure setbacks, opposition, and external pressures while maintaining focus on long-term goals. Leaders who demonstrate resilience can motivate their teams, sustain reform efforts, and navigate the complexities of institutional change more effectively.

"Resilience. I think it's very important when you look at leadership is, do you have resilience and staying power for the changes that are coming in? From whichever direction, resilience is the ultimate."

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Discussion

Effective leadership in curriculum transformation is vital for alignment or coordination, and commitment of stakeholders is necessary to driving innovation, leading change, and cultivating environments that promote interdisciplinary learning and adaptability as part of curriculum transformation (Gerwel Proches, et al., 2025; Middlehurst, 2012). Effective leaders provide a clear vision and direction for curriculum transformation, ensuring that educational goals align with the demands of the modern world, such as innovation and technology adoption. Leadership is also crucial depending on the resilience process stage: when coping with a crisis, leaders are capable of agility in the decision-making process, facilitated by an organizational culture that favors continuous monitoring and improvement of key processes (Gardner Le Gars et al., 2023).

The study highlighted how communication is a pivotal element in the success of curriculum transformation efforts (James et al., 2025). A shared vision, participative leadership, epistemological access, structured governance, stakeholder- motivation, and cultural awareness collectively shape the transformation process. Effective communication fosters engagement, problem-solving, and buy-in, ultimately ensuring that curriculum changes meet the evolving needs of higher education institutions and society at large. To achieve meaningful and sustainable curriculum transformation, educational leaders must prioritize transparent, inclusive, and adaptive communication strategies.

Effective communication is at the heart of curriculum transformation, serving as a means of building trust, aligning teams, and ensuring clarity in expectations. The data suggests that leadership should adopt a two-way communication approach—both influencing and being influenced by team members (Daft, 2023). Clear, concise, and transparent communication fosters an environment where faculty and students understand their roles in curriculum reform. Moreover, effective communication enhances decision-making and ensures that all stakeholders feel valued in the transformation process.

The study findings emphasise the need for a leader who is a visionary capable of anticipation and preparation for both positive or negative future transformation impacting the organisation (Denyer, 2017). Overall, a leader engages the organization in a process of transformation based on organisational, anticipation, and learning capacities despite the resistance the organisation can oppose. Transformational leadership is critical in HE (Bohari et al., 2024). Transformational leadership is particularly significant in not only influencing followers towards a common goal (e.g., educators embrace new teaching methodologies, integrate advanced technologies, enhancing the learning experience) but also achieving DAC of educators to realise curriculum transformation. They cultivate a culture of continuous improvement and encourage experimentation with novel instructional strategies, which is crucial for the evolution (Al-Husseini et al., 2021; Budur, 2020; Delahunty & Kimbell, 2021) and the resilience of STEAM curricula (Waldeck et al., 2024).

The results point to how faculty members may resist change due to entrenched academic traditions, concerns about increased workload, and skepticism about new teaching methodologies. This has been highlighted in previous studies (Lane, 2007). Students and parents may also resist changes that alter familiar learning structures or

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assessment methods. A key aspect of overcoming resistance is motivation. The study emphasizes the importance of engaging stakeholders by demonstrating the benefits of change. Institutional resistance is often exacerbated by bureaucratic structures, slow feedback mechanisms, and centralized decision-making processes. Top-down approaches to curriculum reform can stifle innovation and lead to delays in implementation (James et al., 2025).

Integrating STEAM education requires leaders to provide educators with the necessary training and support. Adapting curricula to include practical problem-solving and fostering an environment that encourages creativity and critical thinking are essential steps in this process (Santana & Bornay-Barrachina, 2024). By adopting transformational leadership practices, providing targeted professional development, and fostering supportive learning environments, leaders can effectively guide their institutions through the complexities of curriculum innovation.

It is clear that information gaps and communication breakdowns create significant obstacles to curriculum transformation. The lack of clear, consistent communication not only impedes the dissemination of information but also undermines trust and collaboration, both of which are essential for successful curriculum transformation. Overcoming these barriers requires a proactive approach, involving leadership buy-in, stakeholder motivation, and regulatory adaptability (Gerwel Proches et al., 2025). Penprase (2018, p. 225) argues that "Our colleges and universities owe it to these students and our future to develop more interactive forms of pedagogy at all levels…".

Stakeholder motivation is a critical enabler of curriculum transformation (James et al., 2025). Leaders must possess motivation skills to secure stakeholder buy-in. This involves marketing the proposed changes effectively and demonstrating their relevance to faculty, students, and external partners. Motivation is also linked to a sense of agency among educators, who should see themselves as active participants in shaping the curriculum rather than passive recipients of top-down directives. A collaborative approach fosters a sense of ownership and investment in curriculum changes.

There is a need for emotional intelligence in HE leadership (Daft, 2023). The findings highlight that leaders must foster empathy, social awareness, and effective communication to create a conducive learning environment. Leaders in curriculum transformation must therefore go beyond structural changes and policies; they must also cultivate meaningful relationships with students and staff. This requires a shift from rigid, top-down leadership to a more engaged, emotionally intelligent leadership style that prioritizes student needs, emotional well-being, and inclusivity in the educational process.

Leaders foster a culture of empowerment and collaboration, encouraging educators and students to actively participate in the transformation process and contribute their ideas. By promoting a mindset of continuous improvement, leaders help institutions adapt to changing educational landscapes and ensure that curricula remain relevant and effective. Investing in leadership training and development programs can help educators develop the skills needed to lead curriculum transformation efforts effectively. Fostering a mindset of quality culture by promoting collaboration, continuous improvement, and professional development has been proven to be properties increasing the resilience of a curriculum (Waldeck et al., 2024; Waldeck et al., 2025).

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Leadership development programs that include coaching can be especially effective in preparing future STEM leaders. They help leaders build the skills needed to manage curriculum changes and support faculty in adopting innovative practices (Okpala et al., 2021). A model developed for principals' STEM leadership capability emphasizes the need for discipline-specific knowledge, contextual understanding, and a disposition towards fostering innovation (Geiger et al., 2023).

Conclusions and Implications

The aim of the study was to explore the role of leadership in curriculum transformation and thereby derive implications for STEAM in HE. The study highlighted that a successful leader in curriculum transformation does not merely enforce policies; they engage, inspire, and strategically plan for meaningful change. The challenge lies in balancing institutional constraints with innovation, policy with practice, and vision with execution. An understanding of the complexities can help HEI leaders develop more effective strategies for navigating and leading transformation in higher education.

Effective leaders in STEAM education play a pivotal role in the curriculum transformation, and guiding academics and students towards an integrated and holistic approach to science education. Since leadership in STEAM education is essential for fostering innovation and creativity in HEIs, their provision of support, direction, motivation, funding, and engagement with staff, is critical. Furthermore, their role in inspiring and guiding the next generation of thinkers and innovators requires being helpful, encouraging, forward-thinking, professionally developed, and providing academic support.

Leadership should create an enabling and empowering environment for science education, which embraces creativity and undermines bureaucracy. There must be constant and effective communication among all levels involved in curriculum transformation in the system to provide direction, alignment, and commitment. They should generate and sustain interest and motivation in curriculum transformation. Moving from STEM to STEAM requires radical transformation and dealing with resistance to change. Leaders in science education should have leadership competencies in change management in order to achieve curriculum transformation. The shared leadership approaches should be collaborative, inclusive, and empowering to avoid excessive bureaucracy. Curriculum transformation requires creating engaged and diverse teams to sharpen direction and motivate each other. It is critical that this be accompanied by adequate support, funding, clear vision, resources, and accountability. Curricula in science education must be readdressed to assess the extent of transformation that is possible and enact this.

The study was exploratory in nature and drew on qualitative research. The data was generated from one workshop, with a small sample. The study findings cannot thus be generalized beyond the study context, but can be transferred to a similar context. The study does, however, provide insights into diverse perspectives into the role of leadership in curriculum transformation. Future research can thus draw on a mixed methods study with a large and diverse sample across various HEIs to gather multiple perspectives. Further studies should develop evaluative tools for the transformed curriculum and nature of the transformation, and its implications for diverse stakeholders.

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Declaration of Interest

The authors declare no competing interest.

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